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# **Risk-Seeking Under Time Pressure: From an Information Load Perspective**

Department of Economics

Bachelor Thesis 15 ECTS

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## **Abstract**

Decision theory has made many additions in the field of risk-behavior. For this paper, we will specifically look at risk-seeking under time pressure, when the information aspect is varied. Subjects took part in a time-constrained in-class experiment to find out if increasing the information amount related to a risky decision (gamble), would increase their risk-seeking behavior. The time aspect was fixed for all subjects, but the information varied. Participants were also asked to report their perceived stress level and to fill in a select few questions from the DOSPERT-scale to assess their over-all risk behavior. No effect could be found in the risk behavior of participants when the information load was increased. Subjects tended to choose the highest paying gamble in both the treatment and control group, which does not support our hypothesis. Nor could any reported increase in stress from the increased information amount load be observed.

Keywords: Decision-making, information load, time constraint, risk, stress

JEL Codes: C91, D80, D91

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# 1 Introduction

Decisions are a part of people's daily routine. Some may be what to eat for lunch or whether to buy that fancy shirt from the store earlier. Some decisions are quite arbitrary, but on occasion, people are faced with more difficult decisions that may impose some risk to our self or our surroundings. Much research has been done in the field of decision-making, both in general form and in a risky setting. Classic theories such as 'Prospect Theory' by Kahneman and Tversky (1979) details people's inability to always think rationally when faced with risky decisions as well as over or undervalue certain risks. Further research has been done by Kahneman (2003) outlining people's rational and intuitive behavior when faced with different kinds of decisions. To quote Kahneman (2003), "For example, it is more natural to join a group of strangers running in a particular direction than to adopt a contrarian destination". Intuition tells us to follow the stream. What they are running from is uncertain and can be dangerous. Decision-making theory even goes as far back as Neoclassical Economic theory, with "Expected Utility Theory" regarding our rational behavior when making decisions (Perloff, 2014). In addition, the technological advancement in recent decennials has enabled investors to handle greater amounts of information in the decision-making process (Merton, 1995). Computers have even begun crowding out the "real" traders who cannot keep up with the millisecond latencies that computers can provide (Nursimulu et al., 2012). Access to advanced trading terminals is paramount to handle the large information loads and keep up as trading speeds increase (Pappalardo, 2011). Furthermore, the globalization and technological advancements of the financial markets permit investors to trade at higher frequencies, demanding decisions to be made faster (Hammer, 2013).

Recent research has proven that in certain cases, a time constraint when making decisions can cause subjects to reverse their preferences (Saqib and Chan, 2015). The research showed that people tend to be more risk-seeking over gains and more risk-averse over losses under time pressure as opposed to the reversed preferences when not under time pressure. However, contrary research has shown that the opposite can be true; that subjects seek safer options when the time pressure increases, as shown by Hasida and Shlomo (1981), subjects tend to lean towards safer options when put under stricter time constraints versus more loose constraints. Time constraints can even in some instances have very positive effects. For instance, in the world of sports 'everything' is done under a time constraint. It is part of what makes it enjoyable and competitive (Freedman and Edwards, 1988), participants are pushed to make split-second

decisions to outperform their opponents. In addition, studies in decision-making have also looked at more biological aspects (Platt and Heutzel, 2008). By looking at the neurological effects of decision-making, they found that specific parts of the brain operate to cause biases in decision-making under uncertainty. Also, people tend to have unstable preferences for risk when the outcome is framed (Tversky and Kahneman, 1981; Kahneman, 2003), affected by emotions (Lerner and Keltner, D, 2000; Lerner, Keltner, and Diener, 2001) and when people are put under time pressure (Nursimulu and Bossaerts, 2014; Saqib and Chan, 2015). Researchers have examined if environmental stressors (e.g., a time constraint given a fixed amount of information) makes people more risk-seeking (Streufert, Streufert, and Denson, 1983). However, there has not been much research on how other potential stressors, such as information load under time pressure, affect risk preferences.

Information is another crucial part of decision-making. Be it risk-related or time constrained, information plays an important part. It has been shown that people tend to look at information differently under time constraints (Maule et al., 2000), they argued that we accelerate our processing of information when a time constraint is applied. Hasida and Shlomo (1981) showed that people seem to filter information more heavily the stricter the time constraint is, trying to focus more on what appears to be the most vital information.

In this paper, we analyze whether the amount of information affects people's risk preferences under time pressure. Our paper differs from other work, as we do not vary the time constraint, but we change the amount of information. Having to consider additional parameters to make a decision is highly relevant in our increasingly information-intensive world. Chewing and Harrell (1990) tested the prospect of information overload in a financial situation and found that participants who experienced information overload tended to make decisions of lesser quality. The application of this prospect for our research is highly relevant.

The purpose of our research is to investigate if people appear more risk-seeking when information load increases. Thus, our research question is: do people behave more risk-seeking when information load increases? In the experiment, the participants were asked to process information related to an "Eckel and Grossman test of risk aversion" -style gamble with six gambles, each paying a low and a high payoff, with a 50/50 chance of receiving each payoff. Where the information-part detailed a crucial piece that had to be used in the gamble to calculate the high payoff for each gamble. The amount of information given in the experiment varied between participants. Half of the respondents answered an "easy" version with little information giving them more time to focus on the gamble, while the other half got an information-heavy version where more time had to be allocated to deduct the crucial piece of information. Lastly,

participants were asked to answer general questions about themselves and their general risk-attitudes. Six questions were picked from the DOSPERT-scale test (Weber, Blais and Betz, 2002). Spread across financial, ethical and physical risk aspects.

From our experiment, we find that subject did not appear more risk-seeking when information load increased. In our research we argue that based on applicable theory, the treatment group will display a higher level of risk-seeking than the control group which we find no evidence for. Overall, participants chose the riskiest gamble most often. This gamble has the highest payoff, 70 SEK, roughly a lunch worth of money in the school's canteen, and 5 SEK as the low payoff. Deducting from the DOSPERT-scale results, participants displayed no profound love or distaste for risk. The average score was indeed very average. Implications for the field of behavioral economics is quite limited. Several weaknesses in the experimental design will be discussed later, which likely had a noticeable effect on the outcome. Although, it is obvious that students find the prospect of a free lunch very appealing.

## **2 Literature review**

In this section, a literature overview of the previous research regarding decision theory will be presented, in the areas of Economics, Psychology, and Cognitive Neuroscience. These areas of research aim to understand and describe how humans make decisions based on evaluation and judgments of predicted outcomes, as well as the biases that can occur (Tversky and Kahneman, 1974; Kahneman and Tversky, 1979). The areas of Economics, Psychology and Cognitive Neuroscience all contribute, aiming to explore and develop theories of decision-making. Economists have provided normative models of decision-making, i.e., how we should make decisions, while Psychologists have presented descriptive models of decision-making, i.e., how we do make decisions. Neuroscientists contribute to theories of the relationship between behavior and the brain (Von Neumann and Morgenstern, 1947; Kahneman and Tversky, 1979). For investigation of the research question, emphasis will be given to the Psychological theories since they are extended theories from Economic theories of decision-making. Also, the Cognitive Neuroscientific perspective of decision-making is overviewed to illustrate findings of biological mechanisms of decision-making.

## 2.1 The Economic Perspective of Decision-Making

Economists have provided a normative approach to decision theory, called Expected Utility Theory which is derived from Neoclassical Economics. Neoclassical Economics focuses on maximizing or minimizing given parameters such as utility, risk, production, and time. The Expected Utility Theory relies on several assumptions regarding that humans behave rational, such as they seek to maximize utility given the highest expected value, have stable preferences, and changes in outcome are perceived in absolute value. Regarding risk preferences, humans are assumed to mostly be risk-averse related to investments. In other words, many investors prefer a sure gain to a chance to win money. In contrast, a human can be considered as risk-seeking if they prefer a chance to win money to a sure gain (Perloff, 2014). However, the Expected Utility Theory has been questioned by Psychologists, suggesting that some of the assumptions that the economic theory of decision-making relies on must be relaxed to investigate how humans make decisions. Also, researchers suggest that human have unstable preferences for risk, i.e., shifting between being risk-averse and risk-seeking, depending on for example, how the outcome is described and time available to the decision-maker (Kahneman and Tversky, 1979; Simon, 1955 among others).

## 2.2 The Psychological Perspective of Decision-Making

Studies in the psychological field have focused on how people make judgments about probabilities for the occurrence of future events, and where the probability is a measure of risk (Kahneman, Slovic, and Tversky 1982; Kahneman, 2003 among others). Researchers have provided empirical evidence and theoretical explanations that support the theory that people do not always behave rationally as suggested by the economic theory (Kahneman and Tversky, 1979; Kahneman, Slovic, and Tversky, 1982; Kahneman, 2003). For instance, the constraints (e.g., time and money) assumed in the Expected Utility Theory might be in nature of external as well as internal (e.g., level of knowledge and cognitive capacity) characteristics (Simon, 1955). Also, Tversky and Kahneman (1979) conducted some experiments where they demonstrated that humans do not always choose the outcome with the highest expected value as suggested by the economic theory, but rather the outcome that humans subjectively perceive as satisfying.

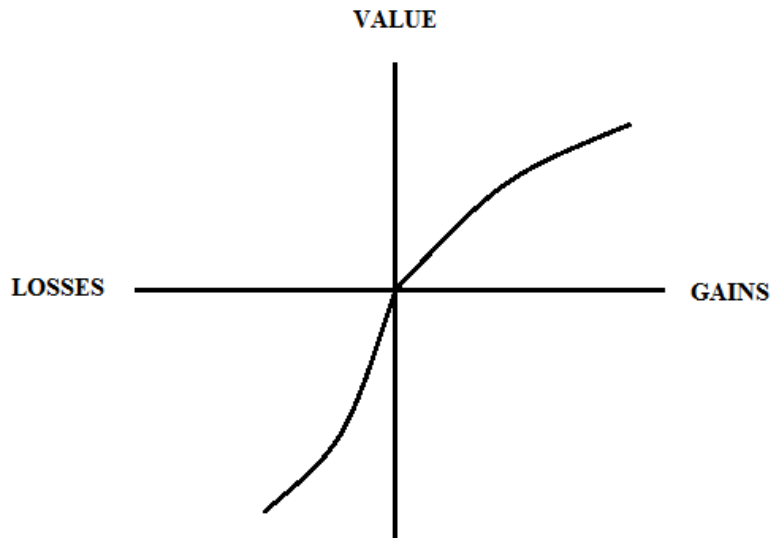
### 2.2.1 Bounded Rationality and Dual System Process

In the last 50 years, psychologists have extended their work and presented models that describe human behavior and judgment in risky and uncertain contexts (Simon, 1955; Tversky and Kahneman, 1979). Simon (1955) proposed that humans are “rationally bounded” and seek outcomes that are satisfying rather than maximizing the decision-makers utility, thus not only focusing on optimization and maximization of parameters. Furthermore, Kahneman (2003) suggested that there are two cognitive systems in the brain that operates for perception and judgment. These perceptual systems demand different levels of mental activity, and they are capable of processing information at various speed. System 1 correspond to the intuitive judgment of humans, it is fast, autonomous, and operates unconsciously. For instance, when humans recognize faces, casual propensity, and distances. System 2 is slow, effortful, and require attention. It operates when analyzing information and reasoning, such as mental arithmetic activities (Kahneman, 2011). Also, human perception is reference-dependent, suggesting that stimulus is perceived different due to changes and states.

### 2.2.2 The Prospect Theory

In 1979, Tversky and Kahneman presented the Prospect Theory, which is a descriptive model of how people make decisions under risk and uncertainty. The Prospect theory consists of a *value function* that represent the tendency for people to evaluate and perceive changes in outcome due to a subjective natural reference point, and not in absolute value as suggested by the Economic theory. The reference point is subjective and inconstant, determined by factors such as experience, expectation, and preferences between prospects (Tversky and Kahneman, 1979; Kahneman, Knetsch, and Thaler, 1991). The value function (Figure 1) replaces the utility function and demonstrates the characteristic that changes in utility are regarding whether humans perceive the outcome as either a gain or a loss, determined relative to the reference point (origo of the value function).





**Figure 1:** A typical value function, presented by Kahneman and Tversky (1979)

Moreover, the value function has several characteristics. First, it displays *loss aversion* which means the decrease in utility for losses looms higher than the increase in utility for gains (Tversky and Kahneman, 1979). It is illustrated by an S-shaped curve for their value function, showing that the change in utility is not an absolute value, but rather that evaluations and perceptions are based on expectations and measured according to a reference point. Second, people have *mental accounts* for investments, hence, different reference points for different investments. When evaluating outcomes, people tend to compare outcomes within categories instead of comparing all outcomes in absolute value (Thaler, Tversky, Kahneman, and Schwartz, 1997).

### 2.2.3 Heuristics and Biases in Decision-making

Previous work has provided empirical evidence that humans are prone to applying heuristics to evaluate outcomes in decision-making. The application of heuristics can lead to cognitive biases that can affect perception and judgement. For example, framing, anchoring, and emotions might affect the decision-making process (Kahneman, Slovic, Tversky, 1982; Nickerson and Salovey, 1998; Thaler, 2008; Tversky and Kahneman, 1974 among others). Heuristics are “rule of thumbs” applied consciously as well as unconsciously, to simplify judgment of probabilistic (risky) outcomes. These heuristics may give rise to systematic estimate errors in the judgmental

operation and lead to biases when evaluating outcomes, meaning that the subjective perception of an outcome can deviate from reality (Tversky and Kahneman, 1974).

#### 2.2.3.1 The Framing Effect

The Economic theory suggests that decisions should be evaluated and based on the expected value of the outcomes and should not be affected by how the outcome is described. However, Tversky and Kahneman (1981) suggested that a “framing effect” can occur due to how the outcome is described, which might cause a reversal of preferences for risky outcomes. In their research, they presented two decision-problems with two prospects to participants, with equal expected value. They found that when the outcome was framed in terms of gains, people tend to be risk-averse: preferring a sure gain to the chance of winning money. Although, yet when the outcome was framed in terms of losses, people tended to be risk-seeking: preferring a chance to lose money to a sure loss. Thus the relative attractiveness of risky outcomes can be affected depending on if the outcome is framed in terms of gains or losses. Framing of an outcome affects the location of the reference point, where a change in reference point influences the evaluation of the outcome that might cause reversal of preferences of risk. The reversal of preferences might cause people to shift between being risk-averse and risk-seeking, depending on how the outcome is framed (Tversky and Kahneman, 1981).

#### 2.2.3.2 The Anchoring Effect

The anchoring effect is the tendency for people to adjust their estimation of an outcome based on an initial value presented in a decision-problem (Tversky and Kahneman, 1974). An anchor value can be a current state or an expectation and can occur semantically as well as strategically if the anchor is compatible with the response scale (Chapman and Johnson, 1994). The anchor can influence the location of the reference point used in the estimation of value as well as the perception of the outcome (Tversky and Kahneman, 1974). For example, a salary proposal for 50 000 SEK will be perceived as a gain for a person with a current salary of 40 000 SEK, but a loss for a person earning 60 000 SEK. The prospect theory suggests that the person that gets a decrease in salary of 10 000 SEK will experience a larger loss than the experienced utility of the person that currently earn 40 000 SEK. Furthermore, if a person expected to get his/her

salary increased from 50 000 SEK to 70 000 SEK, yet instead get 60 000 SEK, this might be perceived as a loss even if it is a gain of 10 000 SEK in absolute value (Kahneman, 1992).

### 2.2.3.3 Influences of Emotions on Decision-Making

Emotions can arise due to environmental stressors, such as information load and time constraints, and might affect task performance as well as risk behavior (Streufert, Streufert, and Denson, 1983). The affect heuristic is the tendency for humans to rely on their emotional response to make judgments (Slovic et al., 2007). People might be more prone to replicate emotions from one situation to the next (Tiedens et al., 2001) and rely on some affect under time pressure (Slovic, P. et al., 2005). In complex decision-situations, exposure to environmental stressors might cause the decision-maker to experience mental strain which can cause stress, which later affects performance to various extent (Streufert, Streufert, and Denson, 1983). According to Streufert and Streufert (1970), mental strain can cause participants to avoid effort in task performance, which might be associated with risk-taking behavior.

### 2.2.3.4 The Effect of Time Pressure on Decision-Making

A time constraint can be a potential environmental stressor to the decision-maker, causing mental strain and affect risk preferences (Streufert, Streufert, and Denson, 1983). When the time is limited people make systematic errors when assessing information to reduce complexity due to capacity limits of the brain, which might affect performance and accuracy of judgment (Kahneman, 2003). Ordóñez and Benson (1997) have investigated risk preferences when time is limited in the decision-making process, and suggest that reversal of preferences can occur. In their research, participants rated the attractiveness of buying prices for gambles under a time constraint. The researchers found that participants tended to change decision-strategies which affect the location of the reference point, used as an anchor point for the evaluation of outcomes. Further, this might cause participants to reverse their preferences for buying prices (Ordóñez and Benson, 1997). Given a time constraint, when people are confronted with information in a judgmental situation, the information has to be processed faster, which might require a different strategy for the decision-making to happen and it can also be biased (Nursimulu and Bossaerts, 2014).

Moreover, Nursimulu and Bossaerts (2014) and Saqib and Chan (2015) demonstrated that people reverse their preferences for risk when put under time pressure, and also seeks to maximize the potential outcome if the outcome is framed in terms of gains. A time constraint might cause people to experience stress, and causes the decision-makers to shift the reference point to the maximal outcome, which affects the evaluation and judgment of the actual outcome (Saqib and Chan, 2015).

Over time, people can gradually acquire and refine skills by practice, learning to assert attentions to information that is relevant to assess and solve a task as reported by Gonzalez, Lerch, and Lebiere (2003). Moreover, the mechanisms in dynamic environments, such as accumulation of knowledge, an adaptation of strategies, and feedback, also impact the decision-making process (Gonzalez, Lerch, and Lebiere, 2003).

## 2.3 Cognitive Neuroscientific Perspective of Decision-Making

In addition to the economic and psychological research in decision-making, the growing field of Neuroscience explores the cognitive system of the brain and the underlying mechanisms of decision-making. With the advancement of technology, Neuroscience has provided valuable insights into encoding information (Drake, 1991; Lieberman and Eisenberg, 2000), and has enabled researchers to contribute to the dual-process theory, investigating how system 1 and system 2 in the brain operates (McLeod, P. et al., 1998; Baddeley, 2000).

By using direct information measures, such as Blood oxygenation level dependent (BOLD) and functional magnetic resonance imaging (fMRI), scientists can measure changes in blood pressure, blood oxygenation, and blood volumes that are associated with brain activity. These measures allow researchers to investigate underlying mechanisms and map brain activity, supporting the dual-system theory (Detre and Wang, 2002; Matthews and Jezzard, 2004). System 1 is associated with instinct behavior, associated learning process (Baddeley, 2000), and system 2 is associated with sequential, abstract thinking, and simulation of future events, but are limited by working memory (McLeod, P. et al., 1998). Likewise, integration of these systems enables the brain to process information at a very high speed (Potter et al., 2014). However, researchers have shown there are capacity limits of the brain regarding attention, the amount of information that is storable, and attended into working memory (Marois and Ivanoff, 2005; Potter et al. 2014).

### **3 Hypothesis**

The purpose of this research is to investigate if an increase in information load can be a potential stressor to the decision-maker and cause them to be more risk-seeking when the outcome is in terms of gains. Based on previous research we state the following hypothesis: If people are confronted with increased information load in the decision-making process, then they will behave more risk seeking.

### **4 Method**

This section will detail all information related to the method used in this research. First, the experimental method will be motivated. Second, the motivation of experimental design, the elicitation method used, and the treatment variation in the experiment will be explained. Third, the questionnaires used in the experiment will be motivated, and the structure of the experiment will be explained. Lastly, the procedure of how the experiment was carried out will be handled.

#### **4.1 Experimental Method**

For this paper, we choose to conduct our research through a controlled in-class lab experiment, as opposed to a field experiment. With the limited time available and precise procedures required to elicit risk preferences with individuals, the lab-style experiment is a clear choice. Field experiments are often argued to be more “realistic” in the sense that they are carried out in uncontrolled real-life situations (Morton and Williams, 2008). However, in recent years, lab experiments have gained ground based on their ability to strictly control the conditions in which they are conducted (Falk and Heckman, 2009), which directly applies to the requirements of our research.

## 4.2 Experimental Design

The design of the experiment was constructed with the purpose to be a natural but accurate way of eliciting risk preferences given the research question and the target audience. Since the total time available for a test in a class with undergraduate students were at maximum fifteen minutes, it was essential to construct an experimental design that would be understandable in written communication.

### 4.2.1 Elicitation Method

In the experiment, a modified version of the “Eckel and Grossman-method” was used (Appendix A) as elicitation method related to the financial-risk domain. Charness, Gneezy, and Imas (2012) presented an overview of different methods for risk elicitations. As suggested in their paper, the researchers have to consider the research question that wants to be investigated and the sample population in consideration when choosing a method for risk elicitation. The Eckel and Grossman-table provide a straightforward overview of the risky choices available to participants, and the method can be incentivized with real money, which has been shown to provide accurate results in real-world studies (Dave et al., 2010). For instance, Eckel and Grossman (2002) used this method when investigating gender differences in risk preference. Moreover, the incentive effect has been investigated by Holt and Laury (2002). They compared experiments where the financial outcome in a lottery was an insubstantial amount of money and a real amount of money. Their findings suggest that when the money was just hypothesized, participants exhibited a lower level of risk aversion, compared to studies where participants were incentivized. Also, participants tended to respond and exhibit risk aversion to a larger extent when the financial incentive was scaled up. In comparison, when the hypothetical payoffs were scaled up, participants were unaffected and did not show any change in the level of risk aversion (Holt and Laury, 2002). Thus, when conducting the risk elicitation, we wanted to account for the incentive effect to get an accurate examination of participant’s attitude toward risk when the quantity of information is manipulated. The possibility of winning real money also contributes to incentivize participants to engage in the experiment fully.

Gamble number	Low payoff (SEK)	High payoff (SEK)
1	30	$20+X = 30$
2	25	$48-X = 38$
3	20	$30+X+6 = 46$
4	15	$64-X = 54$
5	10	$12+60-X = 62$
6	5	$80-X = 70$

*Eckel and Grossman-table used in our experiment with calculated payoffs.  $X = 10$ .*

Our version of the “Eckel and Grossman-table” that can be seen above differs from the original in the sense that it does not convey all necessary information right away. In Part 1 of the experiment, the value for  $X$  has to be deducted from supplied information, which will be discussed later.  $X$  is then used to calculate each payoff for participants to choose their desired gamble. Gamble 1 is considered to signal low levels of risk-seeking behavior, and gamble 6 to signal high levels of risk-seeking behavior. Although a weakness of this method is the ceiling effect that applies to gamble 6. The method cannot deduct whether a participant would appear more risk-seeking than that of gamble 6, given the opportunity. “Would he/she trade the last 5 SEK of the low payoff for the opportunity to win even more?” is a question that this table cannot answer.

There are some further aspects of this elicitation method that must be considered. First, this elicitation method is only framed in terms of gains. Based on methods used in previous research where the effect of time pressure on risk preferences has been investigated, outcomes in terms of losses were excluded from this experiment (Saqib and Chan, 2015). Also, due to time constraints and budget constraints for this research, the inclusion of losses was considered to be too extensive. Second, this method can only categorize participants as “risk-averse,” “risk neutral,” or “risk-seeking.” Hence, it is not possible to determine to which extent a participant is risk-seeking, compared to another participant that is also categorized as “risk-seeking” (Charness, Gneezy, and Imas, 2012). Notwithstanding, the “Eckel and Grossman-method” was considered as a valid method for this research, since previous research has shown that people are risk-averse when the outcome is framed in terms of gains (Tversky and Kahneman, 1981). Third, as the “Eckel and Grossman-method has been shown to be appropriate when eliciting risk preferences, it has only been proven to be accurate when conveyed in English (Eckel and Grossman, 2002). Therefore, the choice for this experiment was to present the information in English, although, participants were expected to be Swedish speaking.

An alternative way to present the information in the symbolic form would be to use an elicitation method that uses visual information. Lejuez et al. (2002) presented The Balloon Analogue Risk Task (BART) to elicit risk preferences. In that experiment, participants are presented with visual information; they are shown a balloon, and their task is to determine how much to pump up the balloon before it cracks. Their potential earning increases with the size of the balloon, however, the risk that the balloon will also crack increases, and if the balloon cracks, the participant loses his or her earnings. As Jackson, McClelland, Kimble, and Gregory (1979) suggests, there is no relationship between visual perception and reading comprehension. Thus, the experimental design of BART can examine risk preferences and still account for inabilities in reading comprehension, which was not a possibility in our experimental design. However, this elicitation method requires all participants to use a computer in a lab, which was not possible at the time of the experiment. Also, there was no clear connection to how information load could be connected to the elicitation method.

#### 4.2.2 Treatment Variation

To investigate if increased information load makes people more risk-seeking, the increase in the amount of information was assigned to the treatment group. Participants were randomly divided into a control group and a treatment group. Both groups were allowed the same time to perform the task and provided with identical task description and a table. The table was required to be used by participants to calculate a value given in the instructions. The design of the table aimed to require effort such as using information from the instructions simultaneously as mental arithmetic.

**Table:**

	A	B	C
1	2	13	15
2	P	10	
3	6	2	25+25

*The table used in the experiment.*

The instructions in the experimental part conveyed the same value of the number X. The control group was given less information to calculate X in part 1:



“Look at the table. Look at the top row of the table. Sum all the numbers in that row. Divide that sum by 3, and find that number in the table. Look at the number in the cell below. You now have the number X!”

However, the treatment group was given longer and more complex amount of information to calculate X in part 1:

“Look at the table. Look at the top row of the table. Sum all the numbers in that row. Divide that sum by 3, and find that number in the table. Look at the number in the cell below. Multiply that number by 5. Take that value and add to the value of cell C3. Divide the number you calculated in the last step by the number in the orange cell. You now have the number X!”

Thus, the length of the instructions was longer for the treatment group. The way that the information was displayed aimed to make a considerable difference in the effort required by participants in their respective groups. The purpose of presenting less information to the control group was to give them enough time for the calculation of X, and not to feel any time pressure. In comparison, by giving the treatment group more information, i.e. a longer text to read, they had to process the information faster to perform the calculation of X within the time constraint. Hence, this was considered to impose time pressure.

### 4.2.3 Questionnaires

In addition to monetary incentivized experiments, questionnaires on behavior are commonly used for eliciting risk preferences. Weber, Blais, and Betz (2002) provide empirical evidence that attitude towards risk can differ across risky domains. For example, a person can be risk-averse regarding financial risk, yet risk-seeking regarding risk related to social life. Therefore, six questions from the DOSPERT-scale (Weber, Blais, and Betz, 2002) were considered to be relevant to control for differences in domain-specific risk preferences.

When questionnaires elicit risk preferences, participants are encouraged to state their propensity for risk on a scale. For example, “Rate your willingness to participate in a risky lottery” from a scale of 1–10, where 1 corresponds to “less willing to participate,” and 10 corresponds to “more willing to participate.” However, these questionnaires are often self-reported and not incentivized. Also, empirical evidence suggests that people tend to differ in attitude toward risk, depending on the elicited domain (Dreber, A. et al., 2011). However, Weber, Blais, and Betz (2002), developed the DOSPERT-scale to capture individual differences

in risk preferences. The DOSPERT-scale includes self-estimation questionnaires about risk in the domains of health, finance, social life, and ethics (Weber, Blais, and Betz, 2002). Their questionnaires consist of a scale from 1 to 7 describing the likeliness to engage or perform the related action where 1 is “Extremely Unlikely” and 7 “Extremely Likely.” However, a weakness of questionnaires is that participants might perceive the situation different afterward, depending on the outcome (Christensen-Szalanski and Willham, 1991). Also, self-reporting does not reveal the exact causal relationship, since there might be other factors in the environment that affect the reported score (Spector, 1994).

#### 4.2.4 Structure of the Experiment

The experiment was set up to consist of three sections. Section one provided participants with general instructions about the experiment and urging participants to comply with the restrictions a timed experiment imply. As a way of controlling that participants had understood the instructions given, and taken in the necessary information, it was stated in section one that participants could only get the opportunity to be paid if they calculated the right number for X. Section two included the actual experiment, divided into two parts. Part one provided a 3x3 table and instructions. The table included numbers, mathematical functions, and colors. Given the table, participants were urged to follow the instructions and calculate a number denoted X. When participants had calculated X, they were supposed to continue to part two of the experiment. In part two, participants were provided the Eckel and Grossman-table, consisting of six gambles including information about the low payoff for each gamble as well as a function of X to calculate the high payoff for each gamble. Section three included general questions, such as gender, education, age and five general questions chosen from the DOSPERT scale (Weber, Blais, and Betz, 2002). Participants were also asked to report their level of stress and then briefly explain their strategy when they performed the experiment.

### 4.3 The Procedure

The experiment was carried out at the School of Business, Economics, and Law at the University of Gothenburg, with 125 undergraduate students (65 men and 60 women). In the experiment, all participants had a ten percent chance to win a cash payout to control for the incentive effect, which has been shown to influence the level of risk aversion and make participants slightly more risk-averse (Holt and Laury, 2002). Participants were randomly assigned to be either in the control group or the treatment group. However, the chance to be assigned to the treatment group or the control group was equal.

Before the experiment was conducted, a pilot study was conducted with 29 participants. The pilots were timed to determine a reasonable time constraint. Also, the pilot study aimed to construct the design of the table used in the experiment. The pilot study showed that the participants could perform the task in between two and a half minutes and three minutes. Consequently, two minutes and forty-five seconds were considered to be an appropriate time constraint in the experiment and was set equally for the control group and the treatment group.

At the time of the experiment, a paper with the experiment was handed out to the participants in the class. Five minutes were given to participants for reading the first instructions, two minutes and forty-five seconds for the experimental parts, and five minutes for answering the questions in the third section. Then, all papers were handed in, and the data was compiled and statistically analyzed in STATA, where the treatment variation was investigated. When the experiment was over, ten percent of participants that had calculated the right number of X was selected for the gamble. In the gamble, a coin was tossed for each of the selected participants. The participant was paid the high payoff if the coin showed tails, and received the low payoff if the coin showed head.

## 5 Results

This section contains the results from the experiment. First, descriptive statistics detailing all measurable values from each group as well as pooled together. Second, an analysis of reported stress level between groups. Third, an analysis of chosen gambles for each group and final words.

## 5.1 Descriptive

*Table 1 depicts descriptive information from the experiment.*

**Table 1**

	Control	Treatment	Total
Number of observations	55	70	125
Percent of right answers	0,96	0,60	0,68
Mean gamble (1-6)	4.58	4.83	4.70
Gamble variance	3.27	2.66	2.96
Gamble st.div.	1.81	1.63	1.72
Percent missed gambles	0,09	0,33	0,22
Percent female	0,53	0,44	0,48
Mean age	24.42	23.80	24.07
Reported mean stress (1-7)	3.45	3.97	3.74
Mean answer (1-7)			
Q1. Invest 10% of annual income	4.98	4.87	4.92
Q2. Return lost and found wallet	1.98	1.84	1.90
Q3. Walk home alone at night	3.80	3.61	3.70
Q4. Choose enjoyable career over safe	5.55	4.89	5.18
Q5. Engage in plagiarism	1.69	1.97	1.85
Q6. Bungee jump off a tall bridge	4.05	3.89	3.96
Overall risk score (6-42)	22.05	21.07	21.50

*“Percent of right answers” show how many percents in each group that managed to give the right answer for the calculation in part 1. “Percent missed gambles” show how many percents of participants that missed to choose a gamble in each group. The “Mean answer (1-7)” section displays the average score from each of the six questions picked from the DOSPERT-scale with the total average displayed at the end.*

Table 1 details relevant descriptive statistics from the experiment. A total of 125 people took part in our experiment, 70 in the treatment group and 55 in the control group. Only 60% of participants in the treatment group managed to answer the question in Part 1 correctly as opposed to 96.63% in the control group. The complexity of the information for the treatment group was indeed much higher than that of the control group, although not to such a degree that 40% of participants should get it wrong. The reason is more likely a combination of the stress factor and pure misinterpretation. As can be seen from a quick glance both the treatment group and the control group show relatively similar numbers overall. Contrary to our hypothesis both groups examined very similar values for the gambling part, with 4.58 and 4.83 respectively, 4.70 for both groups combined on the 6-grade scale. These results show relatively high of risk-seeking for all groups regardless of information amount. The treatment group exhibited slightly higher percentage male participants. This is due to the random selection process of group participants. Although, we can see no gender effect on which gamble participants chose ( $t(95) = 0.3465$ ,  $p > 0.1$  overall) ( $t(48) = 1.0462$ ,  $p > 0.1$  for the control group,  $t(45) = -0.7926$ ,  $p > 0.1$  for the treatment group), it is often believed that women are more risk averse than men which were shown by Irwin et al. (1988), which in term would imply that the treatment group has a positive bias in regard to risk-seeking, but no such effect was found. It could also be interesting to note that 32.86% of participants in the treatment group missed to gamble altogether leaving us with only 47 observations out of 70 to work with in our detailed analysis. The reported stress level is only slightly higher for the treatment group which would only partially explain the reason for the missed gambles. Also “reported stress” is an arbitrary measure and conclusions drawn from it should be taken with a grain of salt.

The inclusion of six questions from the DOSPERT-scale gave further insight into the risk-behavior of the participants. Answers in this section should in no way be affected by which group participants belong to. They are solely objective views of the participant's risk preferences, and as expected, results between the two groups are very similar. On average, the participants displayed high willingness to invest a part of their income in a safe mutual fund (Question 1). Question 2 stated “likelihood to not return a lost and found wallet”. The average score here was low. “Likelihood to walk home alone in an unsafe part of town” (Question 3) showed a slight unwillingness in general from all participants with female participants far less likely to engage in this activity ( $t(123) = 5.10$ ,  $p < 0.01$ ). Question 4 asked participants whether they would choose a career they truly enjoy over a safe one with only slightly over average score exhibiting general indifference to the statement. Question 5 was of great academic importance. “Likelihood to engage in plagiarism”, the average score here was very low. Lastly

and potentially the most “risky” question, likeliness to bungee jump off a tall bridge. A slight overall unwillingness is displayed here. The only question that displayed a significant difference between groups was Question 4 ( $t(123) = 2.67, p < 0.01$ ), although without any further implications for our result. The minor difference shown here is not enough to cause any overall shifts in risk behavior. Participants displayed at large a very risk neutral stance with a total average score of 21.5 out of 42 available points. Causing us to conclude that the test subjects were observably not more risk-seeking nor more risk-averse than each other ( $t(123) = 1.2494, p > 0.1$ ) or the average person.

## 5.2 Stress Level

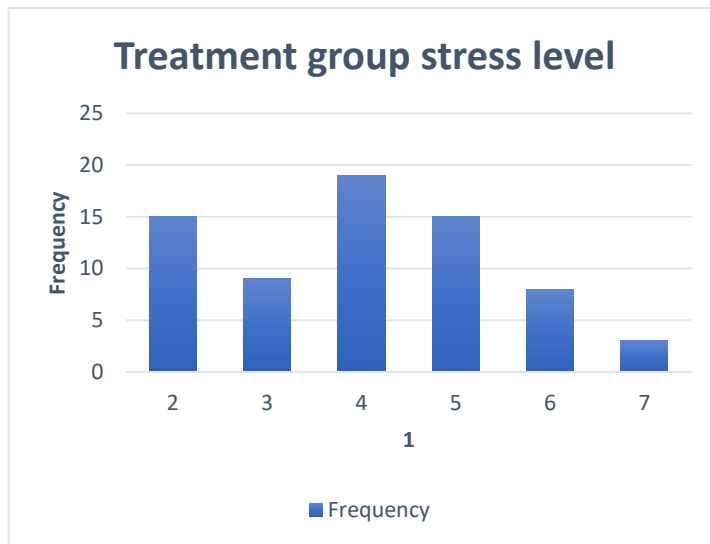
*Table 2 displays the output from a t-test between the control and treatment group regarding their stress levels. The test was done with full sample regardless if subject chose a gamble or not.*

**Table 2**

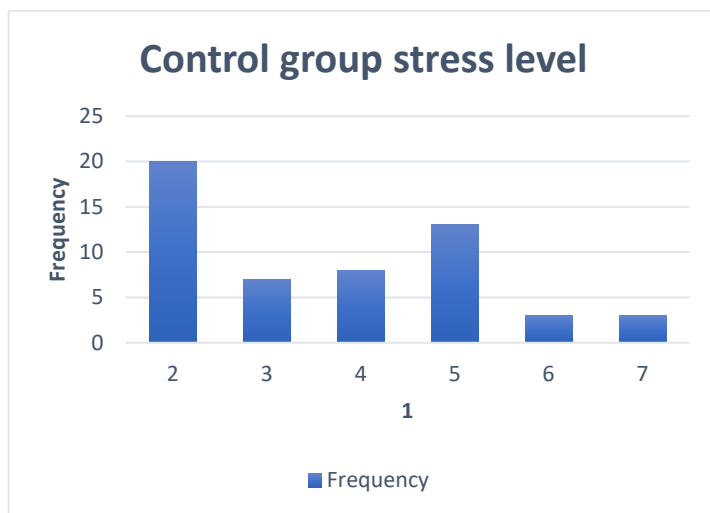
T-test for Stress level by group assuming equal variance

	N	Mean	Std. Error	Std. Div.
Control	55	3.45	0.25	1.81
Treatment	70	3.97	0.19	1.62

Tests for normality gave varying results. Shapiro-Wilk's test of normality could not be rejected. However, Skewness and Kurtosis tests rejected normality for the treatment group and looking at the histograms of distributions we can with some certainty reject normality. Hence, we cannot trust the results from table 2 that provide weak significant evidence that stress levels were different between the control group ( $M = 3.45$  S.D. = 1.81) and treatment group ( $M = 3.97$  S.D. = 1.62) ( $t(123) = -1.6777, p < 0.1$ ). It is not in line with what we wanted to achieve with the experiment. Although as stated, “reported stress” is an arbitrary measure and it cannot be taken as conclusive proof that participants in the treatment group did not feel an increase in stress levels. However, it can be argued that given the difference in information load and comments of “too tight” time frame to complete the “treatment group test” there could be an unobserved difference. Tests for equal variance could not be rejected. Controlling for unequal variance causes no significance ( $p > 0.1$ ). However, we assumed equal variance from earlier testing and chose to disregard these findings.



*The graph displays the distribution of perceived stress level for the treatment group.*



*The graph displays the distribution of perceived stress level for the control group.*

*Table 3 presents a non-parametric Man-Whitney U-test comparing the two groups without making assumptions about the distribution.*

**Table 3**

Man-Whitney U-test			
	N	Rank Sum	Expected
Control	55	3152	3465
Treatment	70	4725	4410

The Man-Whitney test shifts the significance level above 0.1 ( $z = -1.581$   $p > 0.1$ ) causing us to disregard the findings of the above T-test and further conclude that participants did not

experience any significant difference in reported stress between groups. These findings could imply that we will not have any significant difference in gambles because we have no stress effect from varying information between groups.

### 5.3 Gamble

*Table 4 displays the output from a t-test between the control and treatment group regarding their chosen gamble. The test was done with the full sample regardless if subject answered correctly or not in Part 1.*

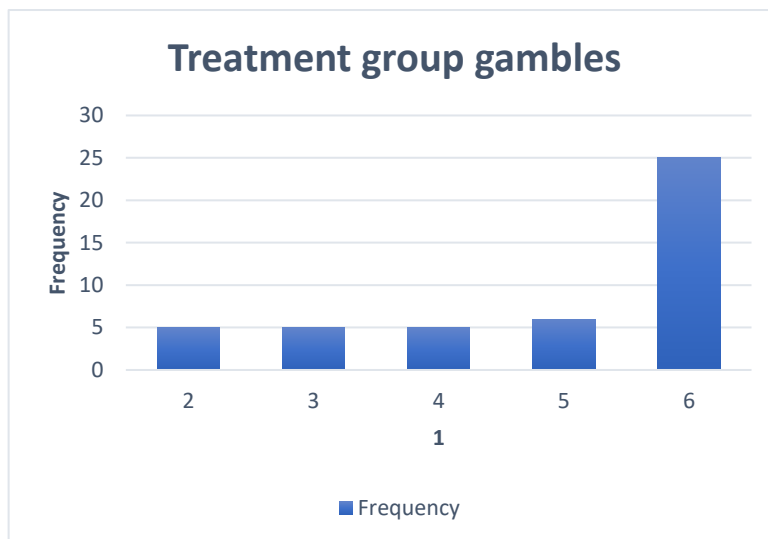
**Table 4**

T-test for Gamble by group assuming equal variance

	N	Mean	Std. Error	Std. Div.
Control	50	4.58	0.26	1.81
Treatment	47	4.83	0.24	1.63

We find that there is no significant difference between the control group ( $M = 4.58$  S.D. = 1.81) and treatment group ( $M = 4.83$  S.D. = 1.63) regarding which gamble they chose ( $t(95) = -0.7126$ ,  $p > 0.1$ ). There is no evidence of unequal variance and controlling for unequal variance show no mentionable difference in the result. Given these results, we cannot reject the null hypothesis, i.e. that subjects would not be more risk-seeking given more information. Controlling for the robustness of the model by comparing results of subjects who answered correctly in part 1 of the experiment to the full dataset as well as including several control variables such as age, gender and stress level causes no significant change in our result and conclusion of the information effect (See Appendix E for table). For our analysis, we choose to include the full dataset to capture any potential effect that stress has on the chosen gamble that is included in subjects who failed to give the correct answer in part 1 of the experiment.





*The graph displays the distribution for chosen gamble for the treatment group.*



*The graph displays the distribution for chosen gamble for the treatment group.*

*Table 5 presents a non-parametric Man-Whitney U-test comparing the two groups without making assumptions about the distribution.*

**Table 5**

Man-Whitney U-test			
	N	Rank Sum	Expected
Control	50	2359	2450
Treatment	47	2394	2303

A test of normality shows that the distributions are not normal, and we hence test the data using a Man-Whitney U-test. Not assuming normal distribution does not change the outcome of the test. ( $z = -0.710$ ,  $p > 0.1$ ). Increased information load does not change chosen gamble in our experiment.

Conclusively, we fail to reject our null hypothesis, i.e. that more information does not make people more risk-seeking. Also, the stress level was not affected by increasing the information load. Although, distributions were presumed not to be normally distributed to reach that conclusion. Gamble was not significantly different between groups when increasing the information load, failing to reject the null hypothesis.

Notably no differences could be found in perceived stress level between gender ( $t(123) = 0.4808$ ,  $p > 0.1$ ) or age groups ( $t(123) = 1.15$ ,  $p > 0.1$ ). Though participants who did not manage to choose a gamble perceived that test as more stressful ( $t(123) = 2.8388$ ,  $p < 0.01$ ). Controlling for unequal variance and not normally distributed samples caused no significant shifts in either of the above tests.

## **6 Discussion**

In this section, the result based on the previous research will be discussed. Then, limits of the research will be considered and lastly, proposals for future research.

### **6.1 General Discussion of the Result**

The results of this research show there is no significant effect of increased information load in the decision-making process that make participants more risk-seeking. In the experiment, participants showed on average consistency in their risk preferences in the control group as well as the treatment group. Further, when examining the results from the DOSPERT-scale, neither group displayed any excessive risk-seeking nor risk-averse behavior that would in some way distort or alter the results. Hence, the results of the experiment do not support the hypothesis that people behave more risk-seeking when confronting more information.

The comments written by the participants of how they thought when they chose a gamble, provided us with insights into how they were affected by the time constraint. A general

comment given by participants in the treatment group was that they did not rethink their decision and “did just pick a gamble.” Also, many commented that they chose the gamble with the highest payoff because they could not lose anything. One possible explanation for the overall high willingness to choose the highest paying gamble could be that the outcome in the gambles were framed in terms of gains and due to the anchoring effect. This explanation would be consistent with Nursimulu and Bossaerts’ (2014) and Saqib and Chan’s (2015) findings, that time pressure might cause participants to maximize the potential outcome when the outcome is framed in terms of gains. Also, it was suggested by the lecturer before the experiment began that the potentially high payoff was roughly 70 SEK, corresponding to a lunch worth of money in the school’s cafeteria. This might have created an anchor for judgment and thus influencing the location of the reference point when participants evaluated each gamble (Kahneman and Tversky, 1974). The lunch at the canteen where compatible with the response scale as it roughly corresponds to the high payoff in one of the gambles, which might have caused participants to discard all other gambles in favor for the highest paying gamble.

Some participants in the control group and the treatment group did not manage to calculate  $X$  and choose any gamble. However, they reported that they experienced stress due to the time constraint, which is consistent with the research reported by Saqib and Chan (2015). As suggested by Streufert, Streufert, and Denson (1983) an environmental stressor (e.g., information load and time constraint) might have caused the participant to experience mental strain due to increased information load, and time pressure because of the time constraint. The mental strain and time pressure might have caused the participant to experience stress, which might affect task performance and risk preferences. Therefore, some participants might have abstained from calculating  $X$  and choose a gamble. However, based on this research, we cannot disentangle whether the absence of an answer is evidence that the risk preference of participants is affected or that this is a weakness of the experimental design. For example, it is likely that participants did not fully understand the task, there could have been lack of motivation to complete the calculations and choose a gamble, disabilities in mental arithmetic, or that they just required more time to finish it.

Further, the theory of affect heuristics indicates that the influence of emotions, such as the feeling of stress, have an effect of how people perceive risk (Lerner and Keltner, D, 2000; Slovic, P. et al., 2005). Some of the participants indicated that they perceived the time constraint negatively as it gave rise to stress and the feeling of uncertainty. One participant even gave up after a minute or so, claiming that she could not handle the pressure of these kinds of tests. The role of emotions is an important part to consider in the decision-making process. The variation

in the amount of information might not have a significant effect on risk preferences. However, the emotion that arises due to the information load and a time constraint might trigger negative emotions and change perceptions of risk. According to Tiedens et al. (2001), emotions affect our judgment and perception of an event, which might cause people to *feel* either certain or uncertain about a choice. Depending on this mental stage, people may replicate this emotion to the following decision which can have an impact on the decision (Tiedens et al., 2001). In our experiment, any feeling of uncertainty about the accuracy of their calculation of the number X in Part 1 might have been incorporated when the participants were urged to choose a gamble in part 2, making people to either refuse to make a choice or “just pick a gamble”.

Parallels to classic Economic theory can also be made. With regard to Expected Utility theory, the overall tendency to pick gamble six is completely rational. As stated in this theory, subjects seek to maximize their utility given the circumstances (Perloff, 2014). Gamble six has the highest expected value out of all the gambles and should accordingly be the clear choice for a utility maximizing individual.

## 6.2 Limits of the Research

Moreover, it is important to point out the limits of this research and the weakness of the experimental design. We want to underline that the purpose of this experiment was to provide a simplification of reality, used to investigate characteristics of behavior, not providing a complete picture of reality. Eckel and Grossman (2002) have used this experimental design to examine differences in gender regarding risk attitude. It might be justified to criticize the method used in this research. It can be enhanced for investigating if information load affect risk preferences. When considering the comments from participants, the payoff might have been a too small amount of money to trigger risk behavior. Many of the participants commented that they chose the riskiest gamble since they could not lose anything and that the gamble that provided the largest high payoff was the only gamble they would potentially profit from. As reported by Holt and Laury, 2002, the degree of risk aversion might be increased if the financial incentive is scaled up.

Further, the experiment was conducted with varied groups of undergraduate students, where the largest parts of participants were currently studying courses in Economics or Business. The risk elicitation was in relation to financial risk, and students in Economics and Business might have more experience managing and be more familiar with these types of risks

since over time, people can acquire skills and develop strategies for decision-making in a specific domain (Gonzalez, Lerch, and Lebiere, 2003). A data collection consisting of students with education in Economics and Business might benefit the students in this experiment, making them less sensitive to changes in risk attitude when varying information load. An interesting enhancement of this experiment could, therefore, be to improve the data collection, including more people in the research to examine if information load influences risk preferences depending on the level of education, age, or gender.

Moreover, one could investigate if the amount of information does affect risk preferences in other risky contexts, for example, risk related to health or social life. Further, the experimental design does only allow categorizing the subjects as “risk averse,” “risk neutral,” or “risk-seeking,” but the method is silent about variation within the categories (Charness, Gneezy, and Imas, 2012). It is plausible that information load affect subjects in different ways, such as making a slight risk-averse person more risk-averse and an extremely risk-seeking person less risk seeking. It should also be noted that the absence of a significant effect of increased information load on risk-seeking behavior, could be a consequence of the ceiling effect discussed in the Method. As the Eckel and Grossman-table does not introduce any gambles beyond gamble number six, it is impossible to elicit if participants would choose an even riskier gamble, given the opportunity. Although, our result does not support our hypothesis, thus, we cannot make any statement about if information load affect risk attitude. An experimental design that measures risk preferences on an interval scale could be appropriate for the purpose to investigate whether information load change degree of risk preference. Moreover, the level of stress was self-reported and was a hindsight estimate (Christensen-Szalanski and Willham, 1991), which might not reveal the exact causal relationship between information load and stress level (Spector, 1994).

It may be justifiable to conduct an experiment where the informational part and evaluation for the risk preferences of participants are independent and where participants are presented with another type of information, such as visual or auditory. In this experiment, all the information was written in English, which might affect the accuracy of communication and the task performance in different ways. A large part of the participants were non-native speakers of English, which might have impacted to which extent participants understood the instructions, making the task appear more complicated than would have been if the task was described in their native language. There are individual differences between participants that influence their performance, such as reading ability, reading speed, reaction time, the difference in reading comprehension and stress tolerance. Instead of questionnaires or presenting participants with

gambles to examine their level of risk-taking, computer simulation can be used to present visual information. An alternative for representing information in symbolic form to examine people's risk preferences could be for instance, The Balloon Analogue Risk Task (BART) presented by Lejuez et al. (2002), which uses visual information for risk elicitation.

### 6.3 Future Research

Future research is needed in this area to determine whether the amount of information given a time constraint affect people's risk preferences. First, we suggest that the experimental design has to be enhanced and made more robust to control for individual differences, the accuracy of communicating how the task will be performed and elicitation of risk preferences. It might be more justifiable to attempt an experiment that accounts for disabilities that can affect task performance. Second, the experimental design in this research only allows the researchers to test for an effect of information in static decision-making. Another approach will be to investigate if the increased amount of information affects people's risk attitude in the context of dynamic decision-making. Investigation in an dynamic environment might capture the effect of mechanisms that can enhance the decision-making process over time. However, the challenge of this investigation would be to construct an experimental design that can account for the acquisition of skills and still impose time pressure in a dynamic environment. Third, further investigation of how time pressure affects the processing of information and emotions that can affect risk preferences would be an essential part to increase understanding of how people make judgments under risk and uncertainty. Therefore, we suggest further research were the outcome can be described in terms of gains as well as losses to account for effects of framing and anchoring.

## 7 Summary

We set out to find how information affects risky decision-making under time pressure. Through important research on the subject, we hypothesized that more information under a time constraint would cause subjects to appear more risk-seeking. We tested this through an experiment where participants were tasked to calculate an important piece of information that

was to be used in calculating the payoff in six potential gambles where they had to choose one according to their risk preference. The amount of information provided varied between the control and treatment group and the time constraint was fixed. We find no significant effect on stress between groups and no significant effect on which gamble subjects choose. However, the results of this research cannot be taken as conclusive evidence of lack of a information load effect. Several weaknesses were found in the experimental design that can have affected the outcome.

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## 9 Appendices

### Appendix A - The “Eckel and Grossman-Table”

Choice (50/50 Gamble)	Low payoff	High payoff	Expected return	Standard deviation	Implied CRRA range
Gamble 1	28	28	28	0	$3.46 < r$
Gamble 2	24	36	30	6	$1.16 < r < 3.46$
Gamble 3	20	44	32	12	$0.71 < r < 1.16$
Gamble 4	16	52	34	18	$0.50 < r < 0.71$
Gamble 5	12	60	36	24	$0 < r < 0.50$
Gamble 6	2	70	36	34	$R < 0$

(*Charness, Gneezy & Imas, 2012*).

## Appendix B - The Experiment (Control Group)

### **Instructions**

**Do not skip ahead in the papers. Wait for the instructions by the experiment supervisor.**

Thank you for participating in our experiment. This experiment may last up to 10 minutes.

In this experiment you will have the opportunity to earn some money. Therefore, it is in your interest to pay attention to the instructions and make careful choices.

#### **Anonymity:**

Should you agree to participate your name will only be connected to your calculation in part 1 of the experiment in order for you to be selected for payment. For the purpose of our research, your answers and the information you provide are kept completely anonymous.

#### **Some Rules:**

Please switch your cell phone to silent-mode (no vibration) and put away anything else that you have brought with you. Please do not talk to other participants during the experiment or attempt to look at the questionnaires of other participants. Do not skip ahead in the papers. Wait for instructions by the experiment supervisor.

If you have any questions at this point, or at any later point during the experiment, please simply raise your hand. A member of the research team will answer it.

Anyone violating these rules may be excluded from the experiment. In this case you will forfeit any earnings.

#### **Structure of the experiment:**

Please find more instructions for the task on the next page.

Please take your time to read all instructions carefully before making any decisions!

**Now, please turn to the next page when you have read the information above carefully.**

## Task description

**Do not turn to the next page before instructed.**

The time will start when you are instructed to turn the page, then you will then have two minutes 45 seconds to solve the test. You are allowed a pencil and if necessary take notes in the right side of the sheet. **No calculator is allowed.** The research team will tell you when the time has passed. You are not allowed to either calculate or write anything more when the time has passed, and please wait for further instructions from the research team. Make sure to allocate your time wisely in order to finish both part 1 and 2 within the time constraint (two minutes 45 seconds).

The next page (experiment) will be divided into *two* parts:

**In part 1**, you will be provided instructions and a 3x3 table. Your task in this part is to *follow* the instructions and calculate a number X.

Example of a table:

	A	B	C
Row 1			
2		Cell B2	
3			

**In part 2**, you will see a list of 6 gambles, which all have different payoffs (payoff = the amount that you can potentially win), denominated in SEK. There is a low payoff written out and a high payoff that will be a function of X which you will have to calculate. Your task in this part is to plug in the value of X in the mathematical function to calculate the high payoff for each gamble. After you have calculated the payoff for each gamble, choose the gamble that reflects your risk preference. (1-6).

## The payout rules

After the experiment is over, the research team will randomly select 10 participants to participate in a gamble. In order to be eligible, you have to calculate the correct value for X in part 1 and choose a gamble in part 2. If you are selected to play the gamble you will have the opportunity to win either the low pay-off or the high pay-off of the gamble you chose in part 2.

In the gamble, you can only win money i.e. you will not lose anything. To determine if the selected participants will receive either the low payoff or the high payoff of the gamble they chose in part 2 of the experiment, the research team will toss a coin (head or tail). Thus, the chance of winning the low payoff or the high payoff is equally possible (50/50).

**Please do not turn to the next page before instructed, otherwise you will be excluded from the experiment and it will not be possible for you to be selected for the gamble.**

## **PART 1**

Please follow the instructions below and calculate X.

### **Instructions:**

Look at the table. Look at the top row of the table. Sum all the numbers in that row. Divide that sum by 3, and find that number in the table. Look at the number in the cell below. You now have the number X!

**Table:**

	A	B	C
1	2	13	15
2	P	10	
3	6	2	25+25

Please state your answer here: X =

Please continue to part 2.

## **PART 2**

Now, calculate the high payoff for each gamble and then choose the gamble you prefer.

Use the number X that you calculated in part 1.

<b>Gamble number</b>	<b>Low payoff (SEK)</b>	<b>High payoff (SEK)</b>
1	30	$20+X =$
2	25	$48-X =$
3	20	$30+X+6 =$
4	15	$64-X =$
		$12+60-X$
5	10	$=$
6	5	$80-X =$

Please, state the number of the gamble that you want to play here: \_\_\_\_\_ (1-6)

## General questions

What is your gender?

Male ☐ Female ☐ Prefer not to answer ☐

What is your age? \_\_\_\_\_

What are you currently studying: program/course?

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Please indicate your level of stress when taking the test. Please answer on a scale from 1 to 7, where 1 means “I did not experience any stress at all when taking the test” and 7 meaning “I did experience a lot of stress when taking the test”.

No stress Much stress

1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For each of the following statements, please indicate the **likelihood** that you would engage in the described activity or behavior if you were to find yourself in that situation. Provide a rating from *Extremely Unlikely* to *Extremely Likely*, using the following scale:

1	2	3	4	5	6	7
Extremely Unlikely	Moderately Unlikely	Somewhat Unlikely	Not Sure	Somewhat Likely	Moderately Likely	Extremely Likely

1. Investing 10% of your annual income in a moderate growth mutual fund. \_\_\_\_\_(1-7)
2. Not returning a wallet you found that contains 1500 SEK. \_\_\_\_\_(1-7)
3. Walking home alone at night in an unsafe area of town. \_\_\_\_\_(1-7)
4. Choosing a career that you truly enjoy over a more secure one. \_\_\_\_\_(1-7)
5. Passing off somebody else’s work as your own. \_\_\_\_\_(1-7)
6. Bungee jumping off a tall bridge. \_\_\_\_\_(1-7)

We would like to understand how you made your decision about the gamble in the experiment. Please, briefly tell us why you chose the gamble in the way you did.

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## Appendix C - The Experiment (Treatment Group)

### **Instructions**

**Do not skip ahead in the papers. Wait for the instructions by the experiment supervisor.**

Thank you for participating in our experiment. This experiment may last up to 10 minutes.

In this experiment you will have the opportunity to earn some money. Therefore, it is in your interest to pay attention to the instructions and make careful choices.

### **Anonymity:**

Should you agree to participate your name will only be connected to your calculation in part 1 of the experiment in order for you to be selected for payment. For the purpose of our research, your answers and the information you provide are kept completely anonymous.

### **Some Rules:**

Please switch your cell phone to silent-mode (no vibration) and put away anything else that you have brought with you. Please do not talk to other participants during the experiment or attempt to look at the questionnaires of other participants. Do not skip ahead in the papers. Wait for instructions by the experiment supervisor.

If you have any questions at this point, or at any later point during the experiment, please simply raise your hand. A member of the research team will answer it.

Anyone violating these rules may be excluded from the experiment. In this case you will forfeit any earnings.

### **Structure of the experiment:**

Please find more instructions for the task on the next page.

Please take your time to read all instructions carefully before making any decisions!

**Now, please turn to the next page when you have read the information above carefully.**



## Task description

**Do not turn to the next page before instructed.**

The time will start when you are instructed to turn the page, then you will then have two minutes 45 seconds to solve the test. You are allowed a pencil and if necessary take notes in the right side of the sheet. **No calculator is allowed.** The research team will tell you when the time has passed. You are not allowed to either calculate or write anything more when the time has passed, and please wait for further instructions from the research team. Make sure to allocate your time wisely in order to finish both part 1 and 2 within the time constraint (two minutes 45 seconds).

The next page (experiment) will be divided into *two* parts:

**In part 1**, you will be provided instructions and a 3x3 table. Your task in this part is to *follow* the instructions and calculate a number X.

Example of a table:

	A	B	C
Row 1			
2		Cell B2	
3			

**In part 2**, you will see a list of 6 gambles, which all have different payoffs (payoff = the amount that you can potentially win), denominated in SEK. There is a low payoff written out and a high payoff that will be a function of X which you will have to calculate. Your task in this part is to plug in the value of X in the mathematical function to calculate the high payoff for each gamble. After you have calculated the payoff for each gamble, choose the gamble that reflects your risk preference. (1-6).

## The payout rules

After the experiment is over, the research team will randomly select 10 participants to participate in a gamble. In order to be eligible, you have to calculate the correct value for X in part 1 and choose a gamble in part 2. If you are selected to play the gamble you will have the opportunity to win either the low pay-off or the high pay-off of the gamble you chose in part 2.

In the gamble, you can only win money i.e. you will not lose anything. To determine if the selected participants will receive either the low payoff or the high payoff of the gamble they chose in part 2 of the experiment, the research team will toss a coin (head or tail). Thus, the chance of winning the low payoff or the high payoff is equally possible (50/50).

**Please do not turn to the next page before instructed, otherwise you will be excluded from the experiment and it will not be possible for you to be selected for the gamble.**

## **PART 1**

Please follow the instructions below and calculate X.

### **Instructions:**

Look at the table. Look at the top row of the table. Sum all the numbers in that row. Divide that sum by 3, and find that number in the table. Look at the number in the cell below. Multiply that number by 5. Take that value and add to the value of cell C3. Divide the number you calculated in the last step by the number in the orange cell. You now have the number X!

**Table:**

	A	B	C
1	2	13	15
2	P	10	
3	6	2	25+25

Please state your answer here: X =

Please continue to part 2.

## **PART 2**

Now, calculate the high payoff for each gamble and then choose the gamble you prefer.

Use the number X that you calculated in part 1.

Gamble number	Low payoff (SEK)	High payoff (SEK)
1	30	$20+X =$
2	25	$48-X =$
3	20	$30+X+6 =$
4	15	$64-X =$
5	10	$12+60-X =$
6	5	$80-X =$

Please, state the number of the gamble that you want to play here: \_\_\_\_\_ (1-6)

## General questions

What is your gender?

Male ☐ Female ☐ Prefer not to answer ☐

What is your age? \_\_\_\_\_

What are you currently studying: program/course?

\_\_\_\_\_  
Please indicate your level of stress when taking the test. Please answer on a scale from 1 to 7, where 1 means “I did not experience any stress at all when taking the test” and 7 meaning “I did experience a lot of stress when taking the test”.

No stress

Much stress

1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For each of the following statements, please indicate the **likelihood** that you would engage in the described activity or behavior if you were to find yourself in that situation. Provide a rating from *Extremely Unlikely* to *Extremely Likely*, using the following scale:

1	2	3	4	5	6	7
Extremely Unlikely	Moderately Unlikely	Somewhat Unlikely	Not Sure	Somewhat Likely	Moderately Likely	Extremely Likely

1. Investing 10% of your annual income in a moderate growth mutual fund. \_\_\_\_\_(1-7)
2. Not returning a wallet you found that contains 1500 SEK. \_\_\_\_\_(1-7)
3. Walking home alone at night in an unsafe area of town. \_\_\_\_\_(1-7)
4. Choosing a career that you truly enjoy over a more secure one. \_\_\_\_\_(1-7)
5. Passing off somebody else’s work as your own. \_\_\_\_\_(1-7)
6. Bungee jumping off a tall bridge. \_\_\_\_\_(1-7)

We would like to understand how you made your decision about the gamble in the experiment. Please, briefly tell us why you chose the gamble in the way you did.

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## Appendix D – DOSPERT-Scale

The DOSPERT Scale (from Blais, & Weber, 2006)

To generate a short version of the scale with items that would be interpretable by a wider range of respondents in different cultures, the 40 items of the original scale (Weber, Blais, & Betz, 2002) were revised and eight new items were added. The response scale was modified slightly by increasing the number of scale points from 5 to 7 and by labeling all of them (i.e., instead of just the two endpoints) in an effort to increase the psychometric quality of the scale (Visser, Krosnick, & Lavrakas, 2000). The new set of 48 items was administered to a group of 372 North Americans, and this group was randomly split into two sub-groups. Data from one sub-group were analyzed in an exploratory manner and resulted in a 30-item model that was tested through confirmatory factor analyses using the other sub-group (Blais, & Weber, 2005).

The *risk-taking* responses of the 30-item version of the DOSPERT Scale evaluate behavioral intentions -or the likelihood with which respondents might engage in risky activities/behaviors- originating from five domains of life (i.e., ethical, financial, health/safety, social, and recreational risks), using a 7-point rating scale ranging from 1 (*Extremely Unlikely*) to 7 (*Extremely Likely*).<sup>1</sup> Sample items include “Having an affair with a married man/woman” (*Ethical*), “Investing 10% of your annual income in a new business venture” (*Financial*), “Engaging in unprotected sex” (*Health/Safety*), “Disagreeing with an authority figure on a major issue” (*Social*), and “Taking a weekend sky-diving class” (*Recreational*). Item ratings are added across all items of a given subscale to obtain subscale scores. Higher scores indicate greater risk taking in the domain of the subscale.

The *risk-perception* responses evaluate the respondents’ gut level assessment of how risky each activity/behavior is, using a 7-point rating scale ranging from 1 (*Not at all*) to 7 (*Extremely Risky*). Item ratings are added across all items of a given subscale to obtain subscale scores, with higher scores suggesting perceptions of greater risk in the domain of the subscale.

The internal consistency reliability estimates associated with the original 48-item English risk-taking scores ranged from .70 to .84 (mean  $\alpha = .78$ ), and those associated with the risk-perception scores, from .70 to .81 (mean  $\alpha = .77$ ), as reported by Weber, et al. (2002). The authors also found moderate test-retest reliability estimates (albeit for an earlier version of the instrument) and provided evidence for the factorial and convergent/discriminant validity of the scores with respect to constructs such as sensation seeking, dispositional risk taking, intolerance for ambiguity, and social desirability. Construct validity was also assessed via correlations with the results of a risky gambling task as well as with tests of gender differences.

### Domain-Specific Risk-Taking (Adult) Scale – Risk Taking

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<sup>1</sup> The six financial items can be split into three gambling and three investment items for further decomposition of the construct. Conversely, all 30 items can be added up, yielding an overall scale score, for a broader assessment of the risk-taking constructs. These models were also tested through confirmatory factor analyses (Blais, & Weber, 2005, 2006).

For each of the following statements, please indicate the **likelihood** that you would engage in the described activity or behavior if you were to find yourself in that situation. Provide a rating from *Extremely Unlikely* to *Extremely Likely*, using the following scale:

1	2	3	4	5	6	7
Extremely Unlikely	Moderately Unlikely	Somewhat Unlikely	Not Sure	Somewhat Likely	Moderately Likely	Extremely Likely

1. Admitting that your tastes are different from those of a friend. (S)
2. Going camping in the wilderness. (R)
3. Betting a day's income at the horse races. (F/G)
4. Investing 10% of your annual income in a moderate growth diversified fund. (F/I)
5. Drinking heavily at a social function. (H/S)
6. Taking some questionable deductions on your income tax return. (E)
7. Disagreeing with an authority figure on a major issue. (S)
8. Betting a day's income at a high-stake poker game. (F/G)
9. Having an affair with a married man/woman. (E)
10. Passing off somebody else's work as your own. (E)
11. Going down a ski run that is beyond your ability. (R)
12. Investing 5% of your annual income in a very speculative stock. (F/I)
13. Going whitewater rafting at high water in the spring. (R)
14. Betting a day's income on the outcome of a sporting event (F/G)
15. Engaging in unprotected sex. (H/S)
16. Revealing a friend's secret to someone else. (E)
17. Driving a car without wearing a seat belt. (H/S)
18. Investing 10% of your annual income in a new business venture. (F/I)
19. Taking a skydiving class. (R)
20. Riding a motorcycle without a helmet. (H/S)

21. Choosing a career that you truly enjoy over a more secure one. (S)
22. Speaking your mind about an unpopular issue in a meeting at work. (S)
23. Sunbathing without sunscreen. (H/S)
24. Bungee jumping off a tall bridge. (R)
25. Piloting a small plane. (R)
26. Walking home alone at night in an unsafe area of town. (H/S)
27. Moving to a city far away from your extended family. (S)
28. Starting a new career in your mid-thirties. (S)
29. Leaving your young children alone at home while running an errand. (E)
30. Not returning a wallet you found that contains \$200. (E)

*Note.* E = Ethical, F = Financial, H/S = Health/Safety, R = Recreational, and S = Social.

### Domain-Specific Risk-Taking (Adult) Scale – Risk Perceptions

People often see some risk in situations that contain uncertainty about what the outcome or consequences will be and for which there is the possibility of negative consequences. However, riskiness is a very personal and intuitive notion, and we are interested in **your gut level assessment of how risky** each situation or behavior is.

For each of the following statements, please indicate **how risky you perceive** each situation. Provide a rating from *Not at all Risky* to *Extremely Risky*, using the following scale:

1	2	3	4	5	6	7
Not at all Risky	Slightly Risky	Somewhat Risky	Moderately Risky	Risky	Very Risky	Extremely Risky

### Domain-Specific Risk-Taking (Adult) Scale – Expected Benefits

For each of the following statements, please indicate **the benefits** you would obtain from each situation. Provide a rating from **1 to 7**, using the following scale:

1	2	3	4	5	6	7
No benefit At all			Moderate Benefits			Great Benefits

#### Reference:

Blais, A-R. and E. U. Weber. 2006. "A Domain-specific Risk-taking (DOSPERT) Scale for Adult Populations." *Judgment and Decision Making*, 1, 33-47.

## Appendix E – Robustness Check

	(1) Gamble	(2) Gamble	(3) Gamble	(4) Gamble	(5) Gamble	(6) Gamble
Control/Treatment	0.251 (0.71)		0.250 (0.70)	0.264 (0.74)	0.254 (0.71)	-
If answered correctly only		0.181 (0.45)	-	-	-	0.218 (0.53)
Stress level			0.004 (0.04)	-0.166 (-0.14)	-0.017 (-0.14)	-0.019 (-0.15)
Age				0.027 (0.83)	0.027 (0.83)	0.029 (0.53)
Gender					-0.107 (-0.27)	-0.054 (-0.13)

t-value in parenthesis ( \* =  $p < 0.1$  \*\* =  $p < 0.05$ )